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PROJECT BRIEFS

Electromagnetic Groundwater Survey

Willowstick Technologies, LLC, and RMOTC are partnering on a project to demonstrate how the "AquaTrack" geophysical subsurface water mapping technology can efficiently map water concentrations and preferential flow paths created from water flood activities in oil reservoirs located in the subsurface. Measured magnetic field data are processed, contoured, and correlated to other hydrogeologic data, enhancing definition of the groundwater body being investigated.

This demonstration could lead to a management tool for the oil industry that would optimize water flooding efforts and other enhanced recovery operations by delineating where water is (and is not) concentrated in an oil reservoir. Having an accurate, cost-effective means to better understand the dynamics of water flooding could help the oil industry significantly reduce costs, optimize production, and increase revenues.

BP America: Hydrate Mitigation

Hydrate mitigation technology tests are underway at NPR-3, utilizing RMOTC's extensive flow loop system. BP America's coiled-tubing propelled tractor is being deployed within the flow loop to test a new composite type of coiled tubing that weighs less than conventional steel coiled tubing. This lighter tubing reduces drag forces and is expected to allow the tractor to travel further into the pipeline. To date, the tractor has successfully operated within the flow loop for a distance of 4,500 feet.

ROCKY MOUNTAIN OILFIELD TESTING CENTER

2005 SPRING NEWS

Office of Fossil Energy

ULTRASONIC TECHNOLOGY
PRE-COMMERCIAL TESTING AT RMOTC

Project Lead: Bryant Mook

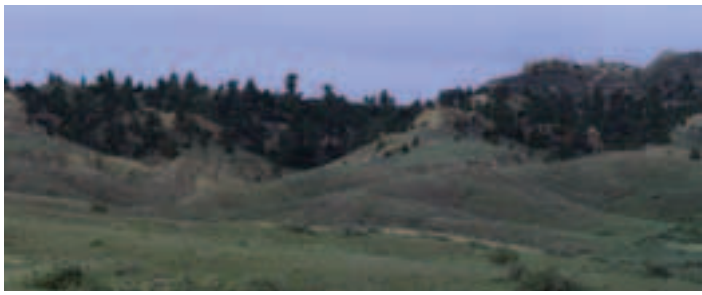
The first successful oilfield application of a promising new ultrasonic technology tool was recently conducted at the Rocky Mountain Oilfield Testing Center (RMOTC) at Naval Petroleum Reserve No. 3 (NPR-3). This acoustic well stimulation (AWS) device uses ultrasound to optimize recovery of proven reserves by reducing skin damage in the near wellbore. Production is stimulated and restored through irradiation of elastic waves.

This promising new technology is the first successful oilfield application of ultrasound on an industrial scale.

In the past, research and development scientists working on ultrasound technology have been unable to make the transition from the laboratory to the development of a functioning commercial oilfield application. The Klamath Falls group has achieved a breakthrough in solving the technical problems that prevented commercialization of this technology. They have designed and built AWS prototype tools that allow the application of high power ultrasound at the depth of the producing formation within the necessary range of frequency to generate results similar to those observed in the laboratory. The device applies a radial pattern of irradiation directly into the formation, perpendicular to the axis of the borehole.

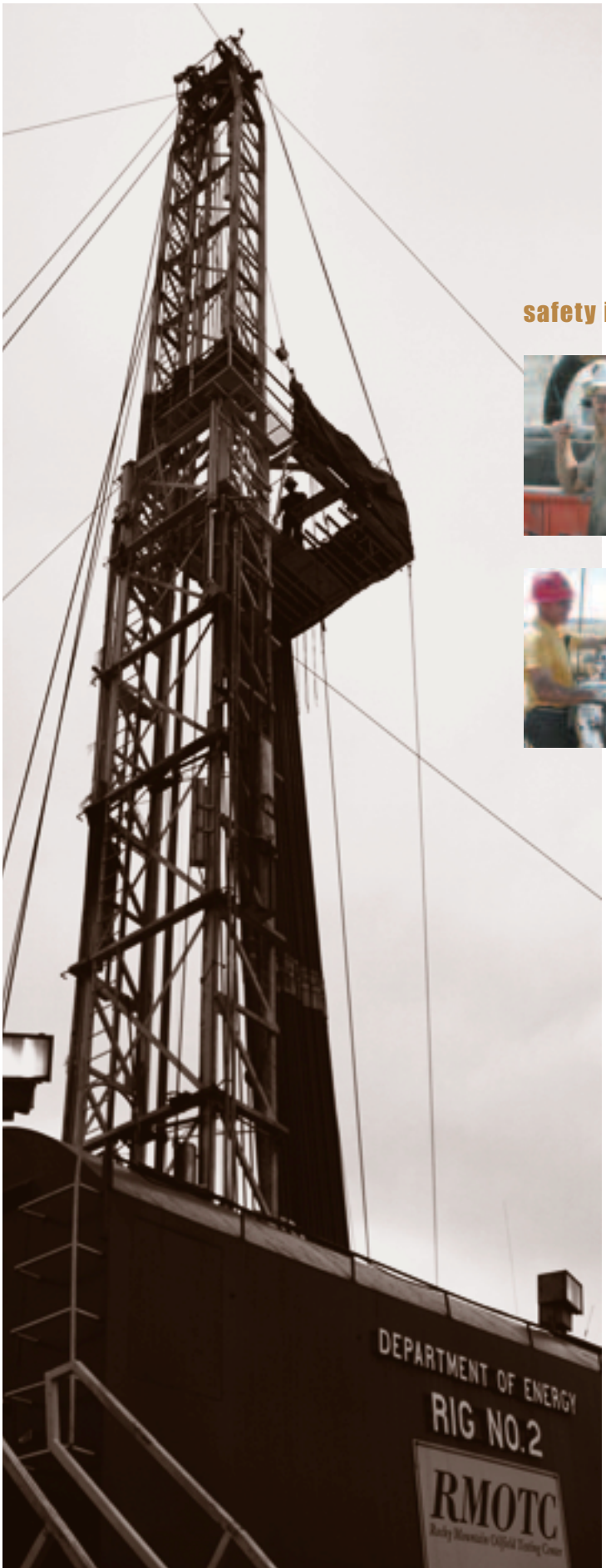
During the ultrasonic test at NPR-3, two different AWS units were tested, a 42-mm diameter tool designed to pass through production tubing and a 100-mm diameter unit that can be used inside casing. The technical characteristics of both units were confirmed in relation to their capacity to generate and transmit stable signals for operational periods of 1 to 2 working hours. This time period represents the time expected to treat a damaged well. The system proved to be robust, showing no signal instability, attenuation, heat buildup, or other problems. The requirements to deploy and position the tool downhole were also established, and the energy consumption of the system was measured.

The Klamath Falls AWS technology tested at NPR-3 confirmed the new technology's main features and



demonstrated its ability to deliver ultrasonic signals in a real wellbore. The positive results from Phase I are being used to design Phase II of testing, in which tests will be conducted in a commercial oilfield with higher production volumes.

SAFETY AND EFFICIENCY:
INFRASTRUCTURE IMPROVEMENTS AT RMOTC



Project Lead: Ralph Schulte

The current RMOTC drilling rig, DOE #2, has served the field well for many years, during many different drilling projects, including Second Wall Creek and Tensleep wells. Wear and tear over twenty years recently became evident and, as **safety is top priority at RMOTC,** it was determined that DOE #2 would be replaced in order to improve the efficiency and safety of the field infrastructure. Two major ticket items are being fabricated by Crown Energy Technologies, Inc.: a new drilling rig and a new pressure truck.

The day is quickly approaching for the delivery of the new drilling rig and, although tradition would name the new rig DOE #4, a new name, RMOTC Rig No. 1, was chosen in order to focus on our current program objectives.

RMOTC Rig No. 1, with a mast height of 118 feet and rated to 375,000 pounds, will be capable of the most demanding field drilling projects, allowing RMOTC to conduct tests with tough requirements in terms of drilling rates, depths, and overall versatility, while greatly improving both safety and efficiency.

The addition of the new high pressure truck will also increase pumping capability for both higher pressure work (up to 8,000 psi) and higher pump rate work. One possible new application will be during the coiled tubing drilling tests with partner Los Alamos National Laboratory.

The process of integrating the new equipment into field operations has already begun, as both the pressure truck and drilling rig should arrive in Casper, Wyoming, by the end of April.

RMOTC'S ROLE IN FOSSIL/RENEWABLE ENERGY

Project Lead: Jim States

Our nation is approaching a new crisis in the availability of fossil fuels caused by a leveling off of domestic oil and gas production and the increased demand from developing Asian countries, particularly China and India. As renewable energy technologies mature, the United States may

be able to utilize these technologies to solve our fossil energy deficit. For example, electrical utilities that use gas-fired turbines are affected by gas price volatility, and may turn to wind power as a cheaper alternative when gas prices spike higher.

RMOTC is currently involved in developing the use of renewable energy sources in several ways:

- A RMOTC team will identify practical ways to use energy conservation measures and to utilize renewable energy sources (wind, solar, hot produced water, and geothermal) to increase the efficiency of oil and gas extraction, potentially increasing the percentage of oil and gas that can be extracted before it becomes uneconomic.
- A second RMOTC team will look for ways to use energy efficiently by reducing operating costs without reducing productivity. Energy sources to be considered are electricity, diesel, gasoline and natural gas.
- RMOTC's Director has teamed with Bill Becker, former director of Energy Efficiency and Renewable Energy (EERE) to form the Rocky Mountain Fossil and Renewable Energy Partnership between regional fossil and renewable energy developers, research institutions, and state energy offices. The partnership will combine the resources of the Department of Energy (DOE), the National Laboratory system, universities, and private sector resources, and provide knowledge and technology leadership to advance the co-development of fossil and renewable energy in production, as well as delivery and end-use systems.
- The Western Governors Association (WGA) has adopted a policy resolution to meet growing energy demand in the Western United States while advancing innovative, clean technologies, and creating a diverse energy portfolio. A series of task forces will examine the clean energy potential from a number of sources. The RMOTC Task Manager has been invited by the WGA to serve on both the wind and geothermal task forces.

CAPSULE VELOCITY TEST
ECONOMICAL P & A SYSTEM

Project Lead: Brian Meidinger

Ben-Cap, LLC of Mills, Wyoming, recently conducted a test at RMOTC on a simple and economical system to plug and abandon wells. Using this method, a cardboard tube containing granulated bentonite is dropped into the wellbore and sinks to the bottom. Upon reaching the wellbore bottom, the tube is activated and deploys bentonite into the well's perforations.

One of the problems in refining this technology is the quantification of the capsule's rate and time of wellbore descent. If the capsule's velocity could be determined, its design could be improved to ensure that it reaches the wellbore bottom before activating.

A test was designed using a clone capsule with the same shape and weight as an actual capsule, but non-dissolving and retrievable. This clone contained instrumentation to record the pressure, temperature, and time data needed to calculate the rate of descent down the wellbore. During the test, the clone was dropped into the well and then recovered in four different runs. The velocity of the capsule was then calculated and found to be greater than anticipated.

Ben-Cap was very pleased to obtain this valuable information through testing at RMOTC and is now working to develop a capsule capable of reaching greater depths than its previous designs.

A well crew drops the capsule into the well.

Gene Theriault, President of Ben-Cap, drops the capsule into the well.

VERTICAL SEISMIC PROFILING (VSP) EFFORT

Project Lead: Mark Milliken

RMOTC recently completed Phase I of a VSP project at NPR-3 in partnership with Lawrence Berkeley National Laboratory. The VSP technology employs acoustic measurements made with geophone arrays placed in vertical wellbores. The arrays are connected to a seismic source at the surface. **The project goal was to capture basic reservoir compartmentalization data, identify fractures and individual rock strata (bedding planes), acquire acoustic reflectance intensity data, and tie to well and 3D seismic data, in order to integrate with other geological mapping and geophysical data.** These data will be used in reservoir modeling to support RMOTC's Carbon Management program.

The VSP project utilized microhole wells from a previous RMOTC test that were drilled and completed using Los Alamos National Laboratory's microhole technology. The wells are located in an area of Second Wall Creek production at NPR-3, and are approximately 800 feet deep. This area is known to be extensively faulted.

After the geophone arrays were positioned in the microhole wells, the seismic source was activated, transmitting acoustic waves through the ground to the wellbores. The geophones then detected the sound waves as they were reflected off bedding planes and fault surfaces. The raw data obtained from this effort is being processed and interpreted, and will then be applied to a structural model. Faults and reservoir compartments can then be identified and evaluated in terms of surface

BEGINS AT RMOTC

A worker runs geophone string into a well during the VSP project.

exposures and leakage potential. Results have been exciting, as acoustic energy from a single vibrator has shown excellent returns from a depth of 3,000 feet.

Phase I initial results show overall good data acquisition. Phase II is currently being planned for summer 2005, and will include a more robust acquisition program with additional wellbores. While current wellbores are spaced along a 2D line, future work plans may include wellbores located in various spacing patterns, allowing for 3D seismic acquisition. Additional acquisition may also include a micro borehole of 0.95 in diameter, drilled to a depth of 1,500 feet.

A Vibroseis buggy is used as an acoustic source in the field at NPR-3.